

Health Consultation

**Evaluation of Contaminants: Domestic wells near
Bainbridge Island Landfill
(December 1998 Sampling data)**

Kitsap County, Washington

CERCLIS # WAD980978720

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**Prepared by
Washington State Department of Health
under cooperative agreement with the
Agency for Toxic Substances and Disease Registry**

FOREWORD

The Washington State Department of Health (DOH) has prepared this health consultation under cooperative agreement with the Agency for Toxic Substances Disease Registry (ATSDR), an agency of the U.S. Public Health Service. The goal of the DOH and ATSDR is to identify and mitigate adverse human health effects resulting from exposure to hazardous substances in the environment. This report was prepared in accordance with methodologies and guidelines developed by ATSDR.

A health consultation provides advice on specific public health issues which may arise as a result of an actual or potential human exposure to a hazardous substance. Health consultations provide a means for DOH to respond quickly to a request for health information on hazardous substances and to make recommendations for actions to protect public health. DOH evaluates available information about hazardous substances at a site, determines whether exposures have occurred or could occur, and reports the potential harmful effects from exposure.

For additional information regarding this health consultation, contact:

Paul Marchant, Public Health Assessor
Washington State Department of Health
Office of Toxic Substances
P.O. Box 47825
Olympia, WA. 98504-7825
(360) 236-3375

BACKGROUND AND STATEMENT OF ISSUES

The Washington State Department of Ecology (Ecology) asked the Washington State Department of Health (DOH) to evaluate potential short-term health threats from vinyl chloride and other contaminants detected in domestic water supply wells in the vicinity of the Bainbridge Island Landfill in Kitsap County, Washington. This health consultation summarizes DOH's evaluation of the public health implications resulting from actual or potential exposure to these contaminants. Although Ecology is evaluating the Bainbridge Island Landfill (site) as a potential source of contamination, in this health consultation the landfill is cited as a reference point only.

Ecology is currently overseeing a Remedial Investigation and Feasibility Study (RI/FS) for the site pursuant to the Model Toxics Control Act (MTCA). The site is located west of Eagle Harbor on Bainbridge Island and covers 40 acres, of which approximately 7 acres were used for refuse disposal. The landfill stopped accepting waste in 1975. The site comprises the northeast quarter of the northwest quarter of Section 33, Township 25 North, Range 2 East. Approximately 1,200 people live within 1 mile of the site and approximately 56,000 people live within 5 miles of the site (1990 census data).

As part of the Bainbridge Island Landfill RI/FS, the Kitsap County Department of Public Works is conducting quarterly sampling of 18 monitoring wells at the landfill and 12 domestic water supply wells located in the vicinity of the landfill to evaluate water quality. DOH recently prepared three health consultations which evaluated and summarized the results of domestic well samples collected near the landfill, one which evaluated sampling data collected between April 1996 and March 1998, one which evaluated sampling data collected in June 1998, and one which evaluated sampling data collected in September 1998. DOH concluded that *no apparent public health hazard existed from exposure to contaminants detected in any of the wells during these sampling periods*. This health consultation evaluates the results of the December 1998 domestic well sampling data. Subsequent health consultations evaluating quarterly domestic well sampling data over the next few years will also be prepared by DOH.

METHODS

How DOH/OTS Evaluates Data

Monitoring well and domestic well sampling data were evaluated without regard to the source of contamination. Although the highest VOC detections are listed in Table 1, only those VOCs detected in domestic wells exceeding an ATSDR cancer and/or non-cancer health-based screening value were further evaluated in this health consultation. Screening values are media-specific concentrations used to select environmental contaminants for further evaluation. Contaminant concentrations at or below screening values are unlikely to pose a health threat. Contaminant concentrations exceeding screening values do not necessarily pose a health threat, but are further evaluated to determine whether they are at levels observed to cause toxic effects (referred to as toxic effect levels) in human population and/or laboratory animal studies. Exposure assumptions used in this health consultation are listed in Appendix A. Exposure formulas are listed in Appendix B.

Evaluating non-cancer risk:

To evaluate the potential for non-cancer adverse health effects as a result of exposure to contaminated environmental media (i.e, drinking water), a dose was estimated for each contaminant exceeding a health-based screening value. In estimating exposure doses, it was assumed that residents were exposed to the maximum detected chemical concentrations in their drinking water. Estimated doses for an adult and for a child through adulthood for each contaminant were then compared to ATSDR minimal risk levels (MRLs) or EPA oral reference doses (RfDs). MRLs and RfDs are estimates of daily exposure of a human to a chemical that is likely to be without an appreciable non-cancer risk over a specified duration of exposure. They are derived from toxic effect levels obtained from human and laboratory animal studies. These toxic effect levels are expressed as either the lowest adverse effect level (LOAEL) or the no-observed adverse effect level (NOAEL). In human or animal studies, the LOAEL is the lowest dose at which an adverse effect is seen, while the NOAEL is the highest dose that did not result in any adverse health effects.

To account for uncertainty, the toxic effect levels are divided by safety factors (usually 100 or 1,000) to provide the more protective MRL or RfD. If a dose exceeds the MRL or RfD, the *potential* exists for adverse health effects. Thus, a dose only slightly exceeding the MRL or RfD would fall well below the toxic effect level. The higher the estimated dose is above the MRL or RfD, the closer it will be to the toxic effect level.

Evaluating cancer risk:

For screening of chemicals which are known or expected to cause cancer, it is assumed that no “safe” level exists, and EPA cancer slope factors are used to calculate an “estimated” increased cancer risk. An exposure which results in an estimated increased cancer risk of one additional cancer in a population of one million people exposed over a 70 year lifetime, is considered an acceptable risk, and is used as the screening value. In a population of one million men in the U.S., 333,000 (one in three) are expected to develop cancer from all causes in their lifetime (through 79 years of age). For U.S. woman, the figure is 200,000 (American Cancer Society Facts and Figures, 1998). The additional estimated cancer risk means that if those one million men are exposed for 70 years to this level of the chemical, 333,001 would be expected to develop cancer. For those one million woman exposed, 200,001 would be expected to develop cancer.

DATA SUMMARY

A total of 12 domestic wells were sampled by the Kitsap County Department of Public Works during the December sampling round. Four of the domestic wells are Group B wells (a public water system that serves more than one connection but less than 25 people or 15 connections) and one is a Group A well (a public water system with 15 or more service connections or an average of 25 or more people per day for 60 or more days within a calendar year). The Group A well serves 1 residence and a school/day care facility. The remaining domestic wells are private wells serving individual residences.

Domestic wells were initially analyzed for many parameters, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polynuclear aromatic

hydrocarbons (PNA), inorganics (total and dissolved), and conventional parameters (total organic carbon, temperature, nitrate, pH, alkalinity, chloride, total dissolved solids, dissolved oxygen, sulfate, etc.). December 1998 domestic well sample analysis included VOCs and conventionals for all 12 wells. No other chemical groups were analyzed during the December sampling round.

Four VOCs were detected at low levels during the December sampling round, although vinyl chloride was the only one which slightly exceeded an ATSDR screening value. Contaminants detected below ATSDR screening values are unlikely to pose a public health threat and will not be discussed further in the health consultation. Table 1 lists the domestic wells with the single highest chemical detections, each chemical's health-based screening value, the well types, well ID, and approximate number of residences served by the well.

TABLE 1
DOMESTIC WELL CONTAMINANTS

(DECEMBER 1998 SAMPLING RESULTS)

| Chemical/Analyte | Highest Concentration (µg/l) | Carcinogenic Screening Value (µg/l) | Non-carcinogenic Screening Value (µg/l) | Well ID | Well Type | Number of Residences Served |
|--------------------------------|-------------------------------------|--|--|----------------|------------------|------------------------------------|
| 1,1-Dichloroethane | 0.2 | NA | 800 (MTCA method B) | BOW37 | Group B | 6 |
| Dichlorodifluoromethane | 1.6 | NA | 2,000 (child RMEG) 1,000 (adult LTHA) | BOW37 | Group B | 6 |
| cis-1,2-Dichloroethene | 0.1 (J) | NA | 3,000/child Int. RMEG; 70/MCL | BOW37 | Group B | 6 |
| <i>Vinyl chloride</i> ☆ | <i>0.35</i> | NA | <i>0.2 (child chronic EMEG)</i> <i>0.7 (adult chronic EMEG)</i> | BOW37 | Group B | 6 |

µg/l = micrograms of chemical per liter of water (equals one part per billion)

RMEG = ATSDR's Reference Dose Media Evaluation Guide

LTHA - EPA's Lifetime Health Advisory for Drinking Water

MTCA method B = WA Model Toxics Control Act Method B groundwater cleanup level

NA = Not available

EMEG = ATSDR's Environmental Media Evaluation Guide

J = estimated value between the calculated detection limit and reporting limit

bolded/italicized compounds = compounds exceeding an ATSDR screening value which required further evaluation

☆ - This was the only vinyl chloride detection during the 12/98 sampling round

Discussion

After evaluating all of the December sampling data, *DOH concluded that no health threat exists for people exposed for 1-5 years to any of the contaminants detected in the domestic wells. Although a very low chronic (long-term) health risk exists from exposure to the maximum concentration of vinyl chloride in well BOW37, there is no apparent public health hazard.* ATSDR uses the “no apparent public health hazard” category for sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.

The Kitsap County Department of Public Works will continue quarterly sampling of domestic wells over the next few years while it evaluates and implements cleanup actions at the landfill. DOH is working closely with the Bremerton-Kitsap County Health District and Ecology, and will continue to evaluate quarterly sampling results to determine future recommendations.

Contaminants exceeding a screening value which were further evaluated:

The following contaminant detected in an individual domestic well exceeded an ATSDR health-based screening value and was further evaluated in the health consultation:

- ▶ Vinyl chloride

Vinyl Chloride

The maximum vinyl chloride concentration during the December 1998 sampling event was 0.35 µg/l from well BOW37, located approximately 800 feet northeast of the landfill. The maximum concentration of vinyl chloride detected in any domestic well since sampling began in April 1996 was 0.77 µg/l from this same well in October 1996. Concentrations in this well slowly decreased from October 1996 through September 1997, then leveled off through the present. Vinyl chloride has been detected at low levels (generally in 12 of the 25 domestic wells sampled (48%) since 1996. Except for well BOW37, however, vinyl chloride has only been detected sporadically.

Vinyl chloride is a colorless gas at normal temperatures. All vinyl chloride is manufactured or results from the breakdown of manufactured substances, such as trichloroethylene, trichloroethane, and tetrachloroethylene (commonly used cleaning and degreasing compounds). Most of the vinyl chloride produced in the United States is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products including pipes, wire, cable coatings and packaging materials. Other uses include furniture and automobile upholstery, wall coverings, housewares, and automotive parts.

Short-term health effects may include damage to the nervous system. Breathing high levels (>1,000 ppm) of vinyl chloride can cause dizziness and sleepiness. Animal studies have demonstrated that exposure to extremely high levels of vinyl chloride can damage the liver, lungs, and kidneys. Other animal studies suggest that long-term inhalation exposure to vinyl chloride may damage the sperm and testes and cause high blood pressure during pregnancy. Studies using pregnant animals show that breathing high levels (2-500 ppm) of vinyl chloride may harm their unborn offspring. Animal studies also show that vinyl chloride may cause

increased numbers of miscarriages early in pregnancy. It may also cause decreased weight and delayed skeletal development in fetuses. The effects of drinking high levels of vinyl chloride are unknown. The MRL was derived from a LOAEL value of 0.018 mg/kg/day for an increased incidence of areas of cellular alteration in the livers of rats.

Results from several studies suggest that breathing air or drinking water containing low levels of vinyl chloride may increase the risk of developing cancer. Hepatic angiosarcomas in Sprague-Dawley rats were observed at doses approximately 5,000 times greater than doses estimated for persons chronically exposed to the December 1998 vinyl chloride concentration in well BOW37. Studies of workers who have been exposed to vinyl chloride over many years also indicate increased incidences of angiosarcoma of the liver. Brain, lung, and some blood cancers may also be attributed to chronic inhalation exposure to vinyl chloride. Studies of long-term exposure in rats indicate that increases in liver and mammary gland cancer may occur at very low levels of exposure in the air (5-250 ppm). The Department of Health and Human Services, International Agency for Research on Cancer, and EPA have determined that vinyl chloride is a human carcinogen.

EPA and the World Health Organization's International Program for Chemical Safety have been reevaluating vinyl chloride since the 1980's. Because of the reevaluation, EPA has removed the oral slope factor. Another peer review panel is scheduled to meet during the spring of 1999 to attempt to achieve consensus on quantifying vinyl chloride's risk. However, for this health consultation, the former oral slope factor of 1.9 was used to estimate the additional lifetime cancer risk from exposure to this compound. The estimated increased cancer risk, assuming chronic exposure to the maximum concentration (0.35 µg/l) of vinyl chloride in drinking water from well BOW37, is approximately 3 additional cancers per 100,000 persons exposed from childhood through adulthood, and approximately 2 additional cancers per 100,000 persons exposed as an adult (very low increased cancer risk).¹ The estimated doses for both the child through adult and adult exposure scenarios are at the chronic oral MRL, but below the less serious LOAEL for oral exposure, indicating that exposure to the maximum detected concentration of vinyl chloride is unlikely to result in adverse non-cancer health effects.

Child Health and Developmental Effects

Vinyl chloride:

No human or animal studies were located regarding developmental or reproductive effects following oral exposure to vinyl chloride. However, some data suggests that fetuses, infants, and young children may be particularly susceptible to the toxic effects of vinyl chloride. Vinyl chloride can cross the placenta and enter the blood of fetuses. Developmental effects have been observed as a result of parental exposures to vinyl chloride in the air. A statistically significant increase in birth defects was observed in three cities in which facilities using vinyl chloride were

¹ A review of Health District records indicate that BOW37 was initially drilled as a private well in 1976. County Assessor records indicate that homes were built and connected to the water supply in 1983, 1986, and the mid 1990s. As a result, estimated exposures, and thus risk, would be even less than this since a 30-year exposure duration was assumed for this health consultation.

located when compared to statewide and county wide averages. The greatest increases were malformations of the central nervous system, upper digestive tract, genital organs, and in the incidence of club foot.

Results of animal inhalation studies indicate that vinyl chloride produces developmental effects at concentrations that are also toxic to maternal animals. Maternal toxicity was evidenced by decreased food consumption, decreased body weight, and increased mortality. Delayed ossification was noted in fetuses at 500 ppm. Vinyl chloride exposed rats throughout gestation showed an increased incidence of hemorrhages, increased edema, decreased hemoglobin and leukocytes and decreased organ weights. However, doses at which developmental effects were observed were several orders of magnitude higher than estimated doses resulting from exposure to vinyl chloride from well BOW37.

Conclusions

No health threat exists for people exposed for 1-5 years to concentrations of contaminants detected in any of the domestic wells sampled to date.

Long-term ingestion/inhalation exposure (DOH assumed 30 years) to the maximum detected vinyl chloride concentration (0.35 µg/l) poses a very low increased cancer risk. Should the concentration increase, the risk would increase correspondingly.

Based on DOH's evaluation of all of the domestic well data provided to date, *no apparent public health hazard exists as a result of exposure to contaminants detected in any of the wells.*

Recommendations

1. Continue quarterly monitoring of domestic wells. Provide DOH with the results of the quarterly monitoring for review and evaluation.

Actions

► DOH completed three health consultations evaluating results of quarterly domestic well samples collected from April 1996 - March 1998, for June 1998, and for September 1998. Quarterly monitoring continues, and Kitsap County Department of Public Works will submit the sampling results to DOH for review and evaluation. Health consultations will be prepared for each sampling round over the next few years.

2. Well BOW37 should be monitored to observe that the concentrations of volatile organic compounds, such as vinyl chloride, do not increase in subsequent sampling events. If vinyl chloride (or other VOCs) show increasing trends or reach federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs), exposures should be reduced or eliminated (options could include treatment or an alternate water source). DOH will continue to review and evaluate quarterly well monitoring results to determine future recommendations.

Actions

► Well BOW37 has been sampled and evaluated, and the owner notified of the results. This well has consistently shown the highest and most frequent vinyl chloride detections and continues to be monitored quarterly for VOCs and conventional parameters.

3. Ecology's March 1995 and March 1998 letters recommending that the Bremerton/Kitsap County Health District limit its well site approval in the areas identified in the vicinity of the landfill should be adhered to.

Actions

► Bremerton/Kitsap County Health District is adhering to Ecology's recommendations.

4. Should future public health intervention become necessary, DOH will work with the appropriate agencies to address the possible long-term need for an alternate water source or treatment for wells determined to be at risk.

Actions

► Thus far, contaminant concentrations and trends have not warranted alternate water supplies. However, DOH continues to evaluate monitoring results and will work with the appropriate agencies to address treatment options or alternate water supplies should they become necessary.

5. DOH is available to review and evaluate the results of any water samples the Bremerton/Kitsap County Health District or area residents may decide to collect from the domestic wells dropped from the Bainbridge Island landfill investigation.

DOH site actions to date:

- ▶ Summer 1998: DOH prepared a draft health consultation evaluating contamination in public and private domestic wells near the Bainbridge Island Landfill.
- ▶ July 1998: DOH prepared and mailed a fact sheet summarizing the health consultation findings to approximately 800 area residents.
- ▶ July 1998: DOH worked closely with the Bremerton/Kitsap County Health District to notify all residents whose wells were evaluated in the health consultation. The health consultation findings were provided to the residents, both verbally, and in writing. The Bremerton/Kitsap County Health District also offered to provide health education to the residents, but they indicated that it was not needed.
- ▶ July 1998: The health assessor summarized DOH activities at the Bainbridge Island Landfill site to be included in the Governor's weekly "Alert" report.
- ▶ August 1998: DOH worked closely with the agencies involved with the site to provide information to the Bainbridge Island Review newspaper for an in-depth article.
- ▶ November 1998: DOH concurred with Ecology's decision to allow the Kitsap County Department of Public Works to eliminate 10 domestic wells from the quarterly sampling program. The rationale presented in Ecology's December 1 letter adequately supports their contention that the landfill is not the source of the contaminants detected in these wells.
- ▶ November 1998: DOH distributed copies of the draft health consultation, which evaluated June 1998 domestic well sampling data. Copies were sent to the community's liaison and agencies involved in the site investigation.
- ▶ December 1998: DOH distributed approximately 75 copies of the final health consultation which evaluated April 1996 - March 1998 domestic well sampling data. Copies were sent to area residents, local representatives, agencies involved in the site investigation, and local repositories.
- ▶ December 1998: Copies of September 1998 draft health consultation were distributed to agencies involved in the site investigation and the community liaison.
- ▶ DOH has communicated with both the U.S. EPA and World Health Organization chemical managers for vinyl chloride to obtain the most current information from the peer review panel's reassessment of this chemical.
- ▶ February 1998: Copies of this health consultation were distributed to agencies involved in the site investigation and the community liaison.
- ▶ A public meeting intended to update the community about the status of site activities, cleanup options being considered for the landfill, and community involvement activities was held on February 23. DOH responded to questions about health concerns from exposure to vinyl chloride and briefly explained our evaluation process. Copies of the

initial health consultation and fact sheets were provided. Follow-up calls were made to individual resident concerns the following day.

- ▶ Ongoing: DOH continues to maintain frequent communication with Ecology, the Bremerton/Kitsap County Health District, and the Kitsap County Department of Public Works regarding site activities and quarterly well sampling results, and plans on preparing health consultations on subsequent domestic well sampling data sets over the next few years. Ecology is revisiting the possibility of a long-term alternate water supply for the users of well BOW37.

Appendix A - Exposure assumptions:

For this health consultation, it was assumed that residents were exposed 350 days per year, for thirty years to the contaminant concentrations highlighted in Table 1. This exposure duration was intended to account for potential past and future exposures, as well as current exposure. Both adult and child through adult exposure scenarios were evaluated. Adults were assumed to consume 2 liters of water per day, and children were assumed to consume 1 liter of water per day until 5 years of age and 2 liters of water per day for the remaining 25 years. Children were assumed to be exposed for 5 years at a 16 kilogram (kg) body weight, for 10 years at a 40 kg body weight, and for 15 years at a 70 kg body weight. Children and adults were assumed to be exposed to VOCs through ingestion (drinking) and non-ingestion (inhalation and dermal contact) routes. Non-ingestion exposures are assumed to occur during household activities such as cooking, bathing, and dishwashing.

Appendix B-Exposure formulas:

It is assumed that non-ingestion (inhalation and dermal) exposures are equal to exposures through ingestion.

$$\text{Exposure dose} = [(C \times IR \times EF \times ED) / (BW \times AT)] \times 2$$

$$\text{Additional lifetime cancer risk} = \text{Estimated exposure dose} \times \text{CSF}$$

where:

C = concentration of contaminant ($\mu\text{g/l}$)

IR = Ingestion rate (liters of water/day)

EF = Exposure frequency (days/year)

ED = exposure duration (total # of years in exposure period)

BW = body weight

AT = averaging time (70 years x 365 days/year)

CSF = Cancer slope factor (Estimates the excess upperbound lifetime probability of an individual developing cancer from an exposure)

References

1. Bainbridge Island Landfill Validated Data Set 11, CH2M Hill, February 24, 1998.
2. Draft Remedial Investigation Report, Volumes 1 and 2, Bainbridge Island Landfill, August 25, 1997. Kitsap County Department of Public Works, Solid Waste Division.
3. Draft Remedial Investigation Report, Supplement No. 1, Bainbridge Island Landfill, May 4, 1998. Kitsap County Department of Public Works, Solid Waste Division.
4. Bainbridge Island Landfill site, Public Groundwater Supplies, Kitsap County, WA., EPA Geographic Information Query System (Version 97.1.8), March 24, 1998.
5. Integrated Risk Information System (IRIS), February 1999.
6. ATSDR Health Consultation Procedures, Agency for Toxic Substances and Disease Registry, May 1995.
7. Toxicological Profile for Vinyl Chloride, U.S. Department of Health and Human Services, Public Health Service, ATSDR, September 1997.
8. Conversations with Barbara Trejo, Washington State Department of Ecology, 1998/99.
9. American Cancer Society: Facts and Figures: 1998 Cancer statistics.

DEFINITIONS

EMEG: ATSDR's Environmental Media Evaluation Guide. A concentration in air, soil, or water (or other environmental media), which is derived from ATSDR's MRL, and below which adverse non-cancer health effects are not expected to occur. Separate EMEGs can be derived to account for acute, intermediate, or chronic exposure durations.

RMEG: ATSDR's Reference Dose Media Evaluation Guide. A concentration in air, soil, or water (or other environmental media), which is derived from EPA's RfD, and below which adverse non-

cancer health effects are not expected to occur. RMEGs account only for chronic exposure.

MRL: ATSDR's Minimal Risk Level. An estimate of daily human exposure to a dose of chemical that is likely to be without an appreciable risk of adverse noncancerous health effects over a specified duration of exposure. MRLs are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specific duration via a given route of exposure. MRLs can be derived for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.

CHRONIC RfD: An estimate (with uncertainty spanning perhaps an order of magnitude) of the daily exposure level of the human population, including sensitive subpopulations, to a potential hazard that is likely to be without an appreciable risk of deleterious effects (non-cancer) during a lifetime. It was developed to be protective for long-term exposure to a compound (7 years or longer).

CANCER SLOPE FACTOR: A plausible upperbound estimate of the probability of a response per unit intake of a chemical over a lifetime. The slope factor is used to estimate an upperbound probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a potential carcinogen.

LOAEL: Lowest Observed Adverse Effect Level. LOAEL's have been classified into "less serious" or "serious" effects. In dose-response experiments, the lowest exposure level at which there are statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control.

NOAEL: No Observed Adverse Effect Level. The dose of a chemical at which there were no statistically or biologically significant increases in frequency or severity of adverse effects seen between the exposed population and its appropriate control. Effects may be observed at this dose, but were judged not to be "adverse".

MCL: Federal Maximum Contaminant Level. A drinking water regulation established by the Safe Drinking Water Act. It is the maximum permissible concentration of a contaminant in water that is delivered to the free-flowing outlet of the ultimate user of a public water system. MCLs are enforceable standards.

CARCINOGEN: Any substance that can cause or contribute to the production of cancer.

CONTAMINANT: Any substance or material that enters a system (the environment, human body, food, etc.) where it is not normally found.

MONITORING WELLS: Wells developed to collect groundwater samples for the purpose of physical, chemical, or biological analysis to determine the amounts, types, and distribution of contaminants.

REMEDIAL INVESTIGATION: A study designed to collect the data necessary to determine the nature and extent of contamination at a site.

COMPARISON VALUE: A concentration used to select contaminants of concern at hazardous waste sites that are further evaluated in the health assessment process. The terms comparison value and screening level are often used synonymously.

MTCA: Model Toxics Control Act. Washington States hazardous waste cleanup law.

FIGURES

Figure 1: Bainbridge Island Landfill Site Location Map

Figure 2: Bainbridge Island Landfill Regional Topography and Surface Water Drainages

Figure 3: Bainbridge Island Landfill Offsite Domestic Wells

Figure 4: Bainbridge Island Landfill Municipal Wells

Figure 5: Bainbridge Island Landfill Municipal Wells